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1445 Ross Avenue  
Dallas, Texas 75202-2733

UIC AREA Permit No. 06S1264P6273

**AUTHORIZATION TO CONVERT or CONSTRUCT  
INJECTION WELLS UNDER THE UIC PROGRAM  
OSAGE MINERAL RESERVE WITHIN THE AREA SPECIFIED**

In compliance with the provisions of the Safe Drinking Water Act, (hereafter referred to as "the Act" or "SDWA") as amended (42 U.S.C. §300f et seq.),

Chaparral Energy  
701 Cedar Lake Blvd.  
Oklahoma City, Oklahoma 73114

is authorized to convert any existing well or construct new injection wells anywhere within the area included in: **the SE/4 of Section 10, the S/2 of Section 11, the SW/4 of Section 12, all of Section 14, and the N/2 of Section 23, all in Township 27N, Range 5E** to inject primarily salt enhanced recovery of oil from the Burbank Sandstone Formation (Burbank Sand). The CO<sub>2</sub> injected may contain incidental amounts of constituents, such as, hydrogen sulfide (H<sub>2</sub>S), nitrogen (N<sub>2</sub>) and oxygen (O<sub>2</sub>), intrinsic to anthropogenic CO<sub>2</sub> and hydrocarbon gases intrinsic to the field production and recycle of CO<sub>2</sub>. The Burbank Sand ranges between approximately **2980 to 3050 feet** below land surface. For purposes of clarifying injection well or monitoring well construction requirements, the base of underground sources of drinking water is 245 feet subsurface in the area specified above. Should this permit be amended to include additional areas, the depth to the USDW for each new area will be specified and applicable only to that area.

Wells may be constructed or converted to injection in the permit area provided the well is within the permit area, the well is operated by the permittee and the well is in compliance with all Parts of this permit. Any new well constructed or converted for this purpose shall comply with minimum construction standards, operational requirements, testing requirements, monitoring requirements and reporting requirements set forth in this permit prior to initiating injection. This permit does not affect the authorization status of injection wells existing on the permit area on the effective date of this permit. Such wells may be added to this permit upon written request of the permittee, including proof that the well complies with this permit and written approval by the Director, Water Quality Protection Division ("Director"). Prior authorization terminates on the effective date of inclusion under this permit.

The permittee shall receive separate authorization to inject for each well before using a well to inject fluids. Authorization to inject for each well before using a well to

to inject shall be confirmed in writing by the Director. A well included under this permit will remain under this permit until it is plugged or this permit is terminated. A well's authority to inject under this permit may be terminated upon conversion to production or any activity that results in a loss of mechanical integrity. During periods wherein a well under this permit is converted to production, its status (producer) must be provided on each report required under this permit for that well. A well's authority to inject may be reissued upon re-confirmation that the well meets the conditions of this permit and demonstrates mechanical integrity.

Deviations from the construction requirements of this permit are considered a major modification to this permit unless managed by increased monitoring or reporting. Major modification to the permit will require the public participation. Increased monitoring or reporting will be addressed as a minor modification to this permit.

This permit shall become effective on

Prepared by

Issued on

Ray Leissner  
Environmental Engineer  
Ground Water/UIC Section

William K. Honker, P. E., Acting Director  
Water Quality Protection Division

6WQ-SG: RLEISSNER: [01-03-12] 06S1264P6273  
6WQ-SG 6WQ-S  
DELLINGER DWYER

- Requirements for Constructing Wells Existing Prior to this Permit
1. Cement shall be placed behind all casing strings, from the top of the Burbank Sand to a height of at least 500 feet above the top of the Burbank Sand.
  2. The outermost casing(s) through underground sources of drinking water (USDW/s) shall be cemented to a depth of at least 50 feet below the base of USDW. For the initial permit area, the base of the USDW is set at 245 feet subsurface. Should this permit be amended in the future to add additional areas, new depths to the base of the USDW will be specified for each area.
  3. For those existing wells without surface casing or whose surface casing does extend at least 50' below the USDW, the top 500 feet of the outermost casing(s) to do so must be cemented to surface.
  4. Prior to initial authorization to inject, the permittee shall provide evidence to the Director of compliance with Parts I. A. 1. and A. 2. above by submitting cementing record and either a cement bond log or temperature log. The permittee shall notify the Osage Nation Environmental and Natural Resources Department (Osage Nation ENRD) at least five days before testing a well under this Part.
  5. Injection shall be through tubing and packer. The packer shall be set within 75 feet of the uppermost injection perforation or top of open hole.
  6. All cements, casings, liners, tubings, packers and tubing-casing annulus fluids employed shall be designed to withstand the anticipated acidic environment.
  7. Burst pressure for the tubulars comprising the tubing/casing annulus shall be rated at 1.5 times the highest differential pressures to which they will be exposed down hole. Existing wells unable to meet this condition shall be equipped with a pop-off valve set to relieve pressures exceeding 10% above maximum authorized surface injection pressures (MASSIP).
  8. The tubing/packer/casing or liner annulus shall be filled with a corrosion inhibiting fluid.
  9. All wells shall be equipped with standard female fittings with cut-off valves affixed to the wellhead in a manner that allows opportunity to detect pressure in each annulus between the tubing and surface casing.

B. Construction Requirements for Newly Drilled Wells

1. Newly drilled wells shall be constructed with surface casing set to at least 500 feet subsurface and cemented back to surface.

3. Prior to initial authorization to inject, the permittee shall provide evidence to the Director of compliance with Parts I. B. 1. and B. 2. by cementing record and either a cement bond log or temperature log.
4. Injection shall be through tubing and packer. The packer shall be set within 75 feet of the uppermost injection perforation or top of open hole.
5. All cements, casings, liners, tubing, packers and tubing-casing annulus fluids employed shall be designed to withstand the anticipated acidic environment.
6. Burst pressure for the tubulars comprising the tubing/casing annulus shall be rated at 1.5 times the highest differential pressures to which they will be exposed down hole.
7. The tubing/packer/casing or liner annulus shall be filled with a corrosion inhibiting fluid. The permittee shall notify the Osage Nation ENRD at least five days before testing a well under this Part.
8. The well shall be equipped with standard female fittings with cut-off valves affixed to the wellhead in a manner that allows attachment of a gauge with a standard male fitting to allow for monitoring pressure in each annulus between the tubing and surface casing.

C. Area of Review (AOR) Corrective Action

1. Before receiving authorization to inject for any well authorized by this permit, the permittee shall complete corrective action and reporting on any well bore within 1/4-mile AOR of the injection well according to Parts I. C. 2. through C. 6. Should the permittee be unable to obtain permission to take corrective action on a well in the AOR, the Director may require additional monitoring according to Part I. C. 6.
2. Any producing, temporarily abandoned, or injection well within the AOR existing before the effective date of this permit shall be constructed according to Parts I. A. 1, A. 2, and A. 6. Any producing, temporarily abandoned, or injection well within the AOR constructed after the effective date of this permit shall be constructed according to Parts I. B. 1, B. 2, and B. 5. Any wells within the AOR to be plugged or re-plugged will be plugged according to standards specified in Part I. C. 3.
3. Any well plugged after the effective date of this permit shall be plugged according to procedures set forth in 40 CFR §147.2905 or as directed by the EPA Tulsa Field Office (EPATFO). The permittee shall provide plugging plans to the Osage Nation ENRD for approval by EPATFO at least five days before initiation of plugging operations.
4. Upon receipt of evidence of upward migration of fluids into or between USDWs, the permittee shall take corrective action to ensure a well previously recognized as plugged, if that

5. The permittee shall submit to the Chief a copy of a signed BIA Form No. 208 or 139, whichever is appropriate, showing the work completed on each well for which corrective action was required.
6. If the permittee cannot locate or implement effective corrective action on any well of record requiring corrective action, a monitor well shall be constructed according to the requirements of Part I. E. Such monitor wells shall be located no more than 25 feet from the recorded location of the subject well. Monitoring and reporting shall be conducted according to the requirements in Parts I. G. and H.
7. After injection commences, corrective action shall be completed, as directed by the Chief, any time evidence of fluid migration into underground sources of drinking water is detected or reasonably suspected.

D. Monitor Well Network

1. A network of monitoring wells shall be constructed to encompass the permit area and may be repositioned to enhance detection of fluid migration into USDWs. This system shall include one monitor well to be placed within 50 feet of the intersection of all quarter sections in the permit area. These monitor wells may be repositioned, if approved by the Chief, to fulfill Part I. C. 6. or in consideration of other criteria including: accessibility, results of corrective action, coverage across the permit area and location of water supply wells.
2. Monitor wells shall be completed as required throughout the quarter section before initiation of CO<sub>2</sub> injection in that quarter section or, when the static fluid level in the injection zone, any place within that quarter section, exceeds the base of the USDW specified for that area, whichever comes first.
3. Before receiving authorization to inject for any well authorized under this permit, the permittee shall submit to the Chief a copy of a report showing construction details of each monitoring well required under Parts I. C. 6. or I. D. 1. of this permit.
4. Monitor wells shall be constructed according to Part I. E. of this permit.

E. Construction Requirements for all Monitor Wells

1. At minimum, monitor wells shall be drilled to the base of the USDW as specified by the permit for the area in which the monitoring well is located and shall be constructed in a manner allowing periodic acquisition of samples representative of water quality in the well at a depth of approximately 10 feet above the base of USDW.

2. The casing in each well shall be a minimum of 2 inches in diameter, extend at least two feet above the surface, be set with cement and/or bentonite from the top of the screened interval to the surface, and secured with a cement pad at the surface capable of preventing surface fluid flow into the well. Details for the construction of ground water monitoring wells can be found in EPA's guidance document: RCRA GROUND-WATER MONITORING:DRAFT TECHNICAL GUIDANCE.

3. Each monitor well shall be secured with a lockable cap, protected to prevent accidental damage from vehicular traffic, and permanently marked with its company identification number and global positioning system coordinates.

#### F. Injection Well Operating Requirements

1. The permittee shall demonstrate, to the satisfaction of the Director, that the injection well has no significant leak in the casing/tubing annulus and allows no fluid migration through vertical channels behind the casing pursuant to 40 CFR §147.2920(b) (1) (i) and (2) (ii) or (iii) respectively. The demonstration of mechanical integrity (MI) must be made at least once every five years thereafter. The Director may require increased frequency of this testing if circumstances deem it prudent. To acquire authorization to inject (ATI), the permittee must submit a successful MI demonstration and proof of cement behind the well's casing(s) in the form of "as built" diagrams with supporting cement bond log(s) or temperature log(s) to the Chief. The Chief may issue ATI either verbally or in writing upon finding the well is compliant with the corrective action, monitoring well and injection well construction and MI requirements of this permit.

2. Each injection well shall be equipped with standard female fittings with cut-off valves affixed to the wellhead in a manner that allows attachment of a gauge with a standard male fitting to allow for monitoring pressure in each annulus between the tubing and surface casing.

3. Injection pressure at the wellhead shall not exceed 850 psig during injection of saltwater and 2165 psig when injecting CO<sub>2</sub>.

4. The permittee is authorized to inject primarily salt water, polymer and carbon dioxide (CO<sub>2</sub>) and minor amounts of fresh or brackish water for enhanced recovery of oil from the Burbank Sandstone formation (Burbank Sand). The CO<sub>2</sub> injected may contain incidental amounts of constituents, such as, hydrogen sulfide (H<sub>2</sub>S), nitrogen (N<sub>2</sub>) and oxygen (O<sub>2</sub>), intrinsic to anthropogenic CO<sub>2</sub> and hydrocarbon gases intrinsic to the field production and recycle of CO<sub>2</sub>. Injection of authorized fluids may be alternated without prior approval.

6. For each injection well authorized under this permit the maximum injection volume for CO<sub>2</sub> is 186 million cubic feet (MMCF) per calendar month. These authorized CO<sub>2</sub> volumes are at standard temperature and pressure (STP). All volumes of CO<sub>2</sub> injected will be reported as if measured at STP.

G. Monitoring Requirements

1. Quarterly, the permittee shall measure static water level and analyze for chlorides, total dissolved solids (TDS) and alkalinity in each monitor well. Samples are to be analyzed according to procedures set out in the most recent edition of Standard Methods for the Examination of Water and Wastewater. To ensure appropriate collection and analysis the permittee must submit a field sampling plan and quality assurance project plan within 90 days of the date of this permit.
2. The permittee shall utilize the first sampling results from all monitoring wells in a quarter section to establish baseline groundwater quality for that monitoring well. The first quarterly sample must be acquired prior to injection in the quarter section.
3. If at the end of two years the monitoring results do not exceed thirty percent of the baseline established for any specific monitoring well by the first quarterly sample analysis in Part I. G. 2., the frequency of sampling that monitoring well can be reduced to once a year, if approved by the Chief.

H. Reporting Requirements

(a) Ground Water Quality Report

1. The permittee shall provide to the EPA, Region 6 quarterly, a report of monitor well sampling during the prior quarter. The reports shall be submitted by the dates shown below. The reports shall include a summary of the analytical results from each monitoring well sampling event for the previous four quarters, in chronological order, signed and dated by the submitting company official. Any monitoring well whose sampling frequency has been extended by approval of the Chief under Part I. G. 3., should be so noted with the date of that approval in the report.

<u>Report Due Date</u>	<u>Reporting Period</u>
March 1	October – December
June 1	January – March
September 1	April – June
December 1	July – September

2. The permittee shall submit a written report to the EPA, Region 6 providing the status of their investigation into the increases and any subsequent corrective actions proposed or taken to protect USDWs.

3. Within five days of the oral report, provided in Part I. H. (a) 2., the permittee shall submit a written report to the EPA, Region 6 providing the status of their investigation into the increases and any subsequent corrective actions proposed or taken to protect USDWs.

(b) Well Identification/Status Report

1. At the beginning of each month the operator shall provide a Well Identification/Status Report (WISR) spreadsheet electronically to EPA Region 6. In column fashion the spreadsheet shall identify by well number and location, all wells currently authorized under the permit or in process of coming under the permit. In addition, the report must certify that the ¼ mile AOR corrective action requirements for each well currently injecting are completed and the date of its last successful mechanical integrity test.
2. Each WISR report shall include a plat map of the project area. This plat map shall show the location of all injection wells listed in the WISR report and all monitoring wells currently operating. Once an area authorized under the permit is fully developed under the permit, the operator may cease submission of the plat map. If the area permit is modified to include additional areas within the Burbank Field, submission of the plat map will be required again, reflecting the additional area(s) until they are fully developed.

Erwin Pino to: Ray Leissner  
Cc: Dennis McPhail, Scott Wehner, John Heinen

From: Erwin Pino <erwin.pino@chapparalenergy.com>  
To: Ray Leissner/R6/USEPA/US@EPA  
Cc: Dennis McPhail <dennism@chapparalenergy.com>, Scott Wehner <scott.wehner@chapparalenergy.com>, John Heinen <john.heinen@chapparalenergy.com>

5 attachments

-  NBU 12-3--2-4-11.pdf
-  NBU 17-2--2-4-11.pdf
-  NBU 17-4--2-4-11.pdf
-  NBU 18-1--2-4-11.pdf
-  201 201 24081152588.pdf

Good Morning Ray,

Please find attached for your review, 1) Burbank produced/injected water compositional analyses (4), and 2) copy of State of OK fresh water usage permit.

We reviewed the fresh water permit. According to the permit we are authorized to use 49,839,752 Bbls of fresh water per calendar year in our flood operations. We have been using far less than this allowable. Our operations are averaging 561,000 BPM of fresh water and 10,518,550 BPM of salt water (recycled from within our Burbank operations). Therefore, your original text in this regard is true to fact—"principally salt water" with the minor constituents being fresh or brackish waters.

With this information in hand, and per our discussions last week, we offer the following text for consideration:

"...to inject primarily salt water, **polymer**, and carbon dioxide (CO2) and minor amounts of fresh or brackish water for enhanced recovery of oil from the Burbank Sandstone formation (Burbank Sand). **The CO2 injected may contain incidental amounts of constituents, such as hydrocarbon gases, hydrogen sulfide (H2S), nitrogen (N2), and oxygen (Ox), intrinsic to anthropogenic CO2. The CO2 injection may contain hydrocarbon gases intrinsic to the field production and recycle of CO2.**"

In addition to the language change in the opening paragraph of this Area Permit, it also should be reflected in condition I.F. 4 of the permit.

Please let us know if you have any question or concern about those comments.

Thanks...

Erwin Pino

Reprint/Rev. Entrainar

Oklahoma City, Oklahoma 73114  
Direct Phone (405) 426-4081  
Direct Fax (405) 425-8681

----- Message from scan <scan@chaparralenergy.com> on Tue, 24 Jan 2012 13:11:52 +0000 -----

cc: Erwin Pino <erwin.pino@chaparralenergy.com>

This E-mail was sent from "16186" (8045e).

Scan Date: 01.24.2012 08:11:52 (-0500)

Queries to: scan@chaparralenergy.com

From: Erwin Pino <erwin.pino@chaparralenergy.com>  
To: Ray Leissner/R6/USEPA/US@EPA

1 attachment



chaparral draft area permit. Final draft.doc

Ray,

I had a meeting with the EOR Manager and we discussed some concerns about of the changes made by EPA on the first paragraph of the last redline version. Here are some comments that came out at the meeting:

- I know I suggested the word "minor" in the last redline version, but we agreed that is open-ended to interpretation. We would like to avoid any inconvenience in the future.
- These constituents are not "incidental to oil field production", they are incidental to the anthropogenic Source of the CO2.

I have attached the last redline version of the CO2 permit . In the first paragraph, we did suggest an statement that may clarify the way how we are going to be injecting water and CO2 within of the Area Permit.

I hope we can get a positive response of this final comment and go to public notice very soon .

Thanks for all your help in this matter .

## Erwin Pino

Regulatory Engineer  
Chaparral Energy, L.L.C.  
701 Cedar Lake Blvd.  
Oklahoma City, Oklahoma 73114  
Direct Phone (405) 426-4081  
Direct Fax (405) 425-8681

From: Leissner.Ray@epamail.epa.gov [mailto:Leissner.Ray@epamail.epa.gov]  
Sent: Friday, December 16, 2011 2:56 PM  
To: Erwin Pino  
Cc: Dellinger.Philip@epamail.epa.gov; Bierschenk.Arnold@epamail.epa.gov  
Subject: RE: FW: Draft Permit Comments

Here's the permit back with the changes in redline as a result of the first comment you sent below.

On the second comment on the second page, the statement declares that the authority to inject may be terminated..... The "may" allows EPA the option, which is rarely exercised. The default here is the ATI remains intact and the ability to repair quickly prove MI and initiate injection remains available. However, in the event that there are extenuating circumstances, EPA wants to retain this option.

On the third comment under Part I. A. 3., wherein Chaparral asks for a 24 hour notice instead of the five day notice, I am told this is a standard permit procedure which has been set in place to give the Tribal office ample time to adjust inspector schedules, should they choose to inspect the operation.

About going final -- Now that the end of year is upon us, many managers are out on leave. Its my opinion that EPA may wait until their return to get their feedback before we go to notice on this permit. Thanks for your assistance.

Ray Leissner, Env. Eng.  
Ground Water / UIC Section (6WQ-SG)  
(214) 665 - 7183  
USEPA, Region 6

The FIRST STEP in protecting your ground water is to have your well tested.

From: Erwin Pino <erwin.pino@chaparralenergy.com>  
To: Ray Leissner/R6/USEPA/US@EPA  
Cc: John Heinen <john.heinen@chaparralenergy.com>  
Date: 12/16/2011 11:18 AM  
Subject: RE: FW: Draft Permit Comments

Good Morning Ray,

I am Sorry ....I just only sent you the Jason Maly's question yesterday while I was working with the Redline Final Version of CO2 Area. I finished it this morning and here is the attachment. Please let me know your response to this final version before get it to the public comments.

I will be on vacation this coming week, so if you will send me your response next week, please CC to John Heinen (john.heinen@chaparralenergy.com) and he will take care of it.

Thanks...

## Erwin Pino

Regulatory Engineer  
Chaparral Energy, L.L.C.  
701 Cedar Lake Blvd.  
Oklahoma City, Oklahoma 73114  
Direct Phone (405) 426-4081  
Direct Fax (405) 425-8681

From: Leissner.Ray@epamail.epa.gov [mailto:leissner.Ray@epamail.epa.gov]  
Sent: Friday, December 16, 2011 10:44 AM  
To: Erwin Pino  
Subject: Re: FW: Draft Permit Comments

Erwin,

Did you intend to provide an attachment to your email below? You did not cover the items we discussed over the phone. For instance, the language specifying the incidental trace contaminants that normally comes along with anthropogenic CO2. I need record of the comments and supporting rationales.

Plus, I see Mr. Malys's point. We are in discussions on that one and will respond soon. Thanks.

Ray Leissner, Env. Eng.  
Ground Water / UIC Section (6WQ-SG)  
(214) 665 - 7183  
USEPA, Region 6

The FIRST STEP in protecting your ground water is to have your well tested.

From: Erwin Pino <erwin.pino@chaparralenergy.com>  
To: Ray Leissner/R6/USEPA/US@EPA  
Date: 12/15/2011 03:15 PM  
Subject: FW: Draft Permit Comments

Ray,

As you can see below, we still have some questions about of the permit conditions of the CO2 Area.

## Erwin Pino

Regulatory Engineer  
Chaparral Energy, L.L.C.  
701 Cedar Lake Blvd.  
Oklahoma City, Oklahoma 73114  
Direct Phone (405) 426-4081  
Direct Fax (405) 425-8681

From: Jason Maly  
Sent: Wednesday, December 14, 2011 9:19 AM  
To: Erwin Pino  
Cc: Dennis McPhail  
Subject: RE: Draft Permit Comments

When will the EPA consider the well repaired? We have several wells which the liners have been installed and cemented to the "prior to permit" conditions (50' below USDW), but we are waiting on tubing and packers to be delivered. If the permit is approved before we have the tubing and packers installed, will we have to shoot and squeeze cement behind the liner to bring the well up to "post permit" conditions (cement from 500' to surface)? In this situation, the vast majority of work was done before the permit will be signed, but due to long delivery times of tubing and packers, the well would not have been MIT'd until after the permit is approved.

Jason Maly  
District Production Engineer  
Chaparral Energy LLC  
405-613-7172 Cell  
405-426-4567 Office  
405-425-8967 Fax

From: Erwin Pino  
Sent: Monday, December 12, 2011 8:46 AM  
To: Dennis McPhail; Scott Wehner; Mike Pickett; Jason Maly; Silvia Ortiz de King  
Subject: FW: Draft permit

Good Morning,

See details below. Let me know if you have any question or concern about this final draft permit and we can discuss any change that you may want to request to EPA.

Thanks...

Regulatory Engineer  
Chaparral Energy, L.L.C.  
701 Cedar Lake Blvd.  
Oklahoma City, Oklahoma 73114  
Direct Phone (405) 426-4081  
Direct Fax (405) 425-8681

From: Leissner.Ray@epamail.epa.gov [mailto:Leissner.Ray@epamail.epa.gov]  
Sent: Friday, December 09, 2011 12:31 PM  
To: Erwin Pino  
Cc: Dellinger.Phillip@epamail.epa.gov  
Subject: Draft permit

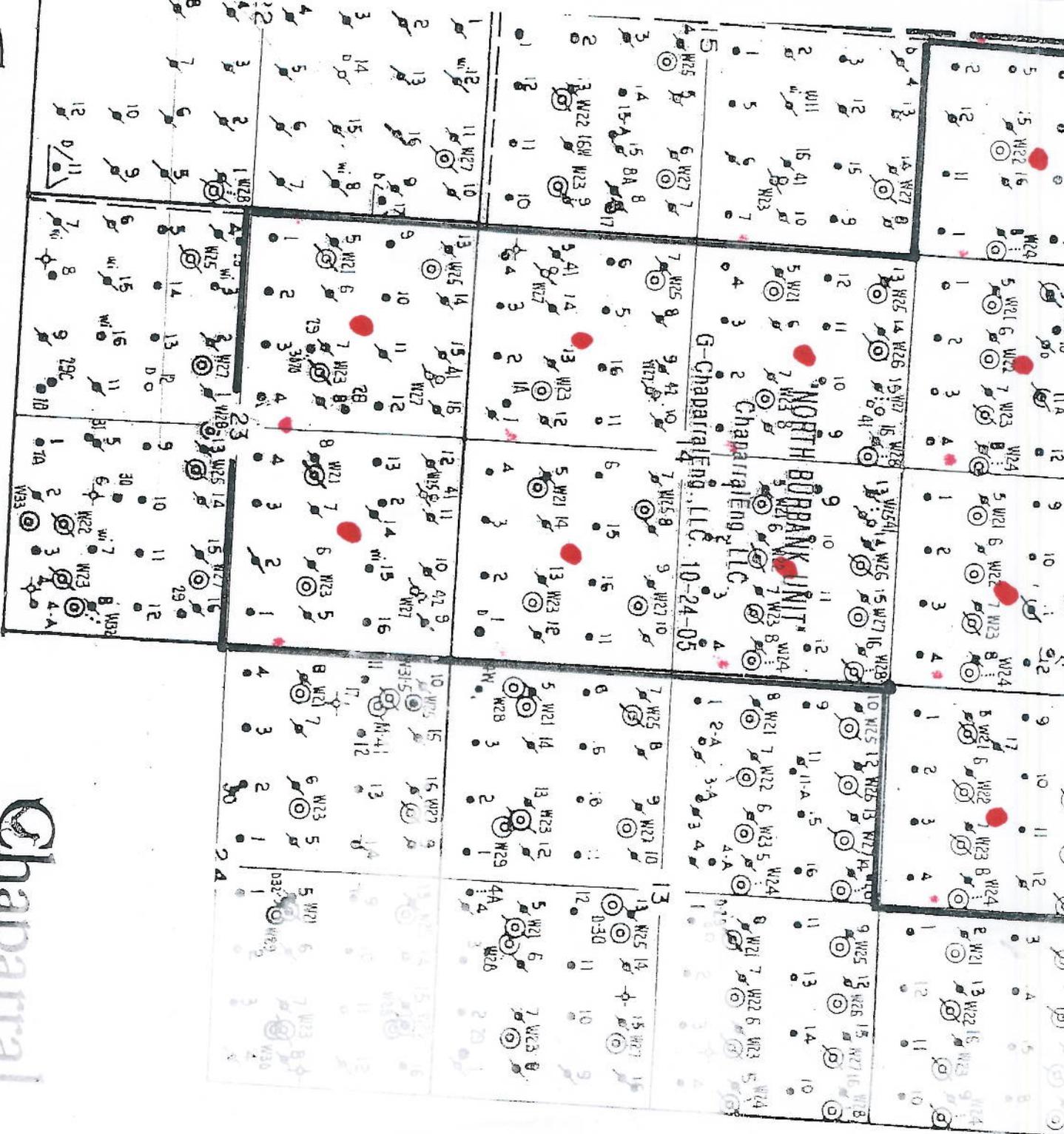
Erwin

Here is the draft for your review. Some of David's comments were accepted outright, some were accepted but rewritten slightly and some we declined. Please call me if you wish to discuss. If I don't here from you by the middle on next week I'm proposing we go to public notice. Chaparral will have at least 15 to 30 days in which to comment if we do. Thanks

Ray Leissner, Env. Eng.  
Ground Water / UIC Section (6WQ-SG)  
(214) 665 - 7183  
USEPA, Region 6

The FIRST STEP in protecting your ground water is to have your well tested.





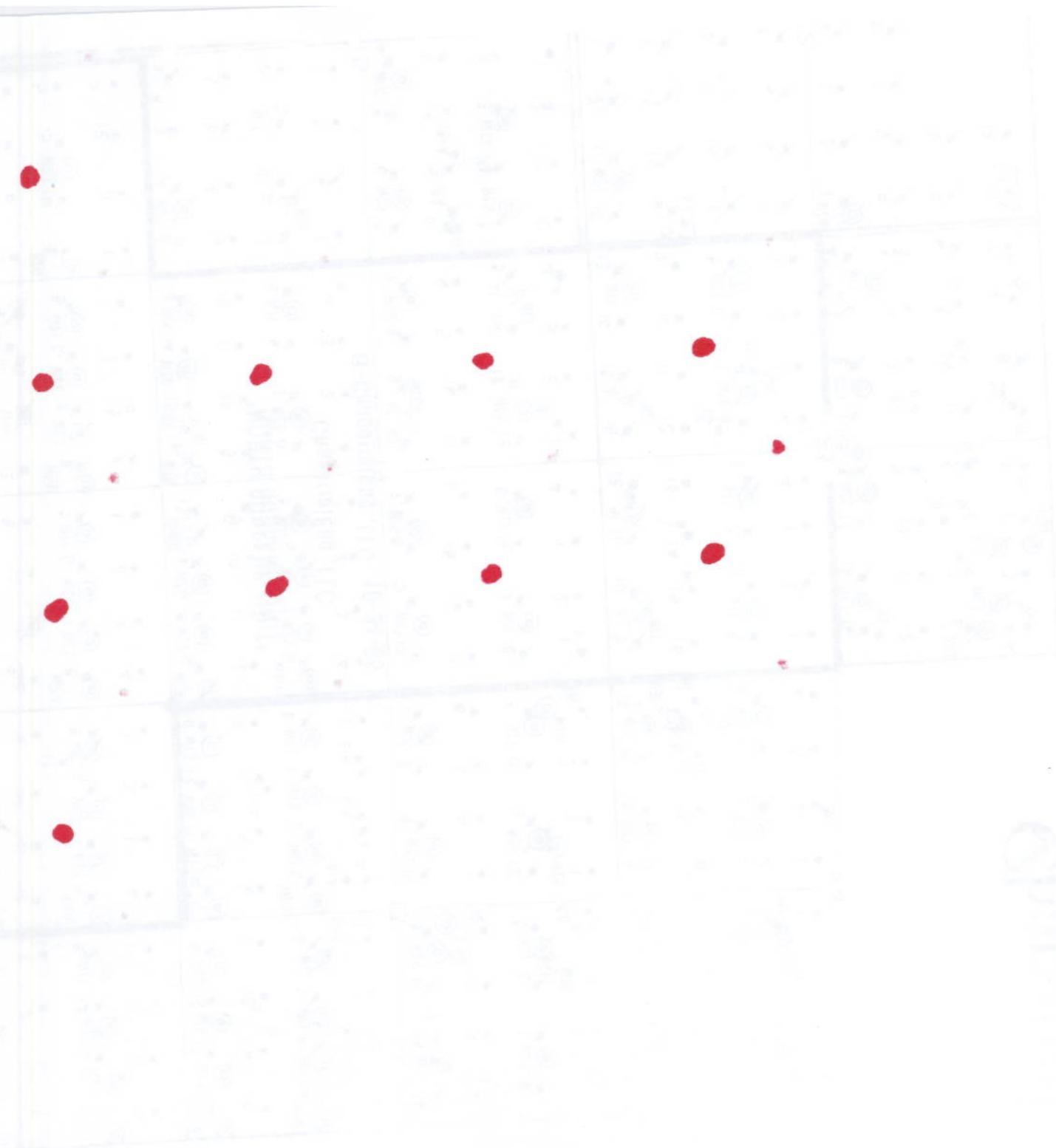
This represents the size & boundaries of the latest (10/12/10) application for an Area Permit.



North Burbank Unit Co<sub>2</sub>

Area I Permit Area

Osage County, Oklahoma



The number of dots in each cell is as follows:

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5	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1

Grid

1000



09/30/10



LYMAN

WEBB CITY

